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Selective Vignetting of Type 1 X-Ray Telescopes

A technique has been developed for optimizing the performance of a Type 1 X-ray telescope by applying a special ray trace program. It has been shown that the image quality of the telescope system can be improved by matching the detector to the optimum focal surface and by vignetting rays which formerly contributed to the flare in comatic images.

Analysis of the optical imaging characteristics of the Type 1 (concave parabola followed by a concave hyperbola) X-ray telescope permits the scientist to design experiments using such optics in a quantitative manner with a full understanding of trade-off in spectral resolving power versus weight and optical efficiency considerations.

Vignetting, of itself, in this type of telescope is not new, but the "selective" vignetting technique involved here is the first *quantitative* technique with the following advantages: (1) Image quality is enhanced (or spatial resolving power is increased) by decreasing the length of the secondary (hyperbolic) element of the telescope; (2) An optimization point in the foreshortening of the hyperbolic element is established beyond which, if exceeded by further decreasing the element length, loss of energy in the image would result with

no compensating improvement in image quality; (3) Establishment of the minimal area requiring optical figuring; (4) A decrease in telescope weight and size to a minimum while attaining an optical resolving power exceeding that of unvignetted configuration.

Notes:

1. While there does not appear to be significant industrial application potential for X-ray telescopic, with modification, this technique should be useful in X-ray microscopy having many industrial applications, particularly in the field of materials analysis, medical research, and imaging of low energy particles.
2. Documentation is available from:

Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Price \$3.00
Reference TSP69-10075

Patent status:

No patent action is contemplated by NASA.

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